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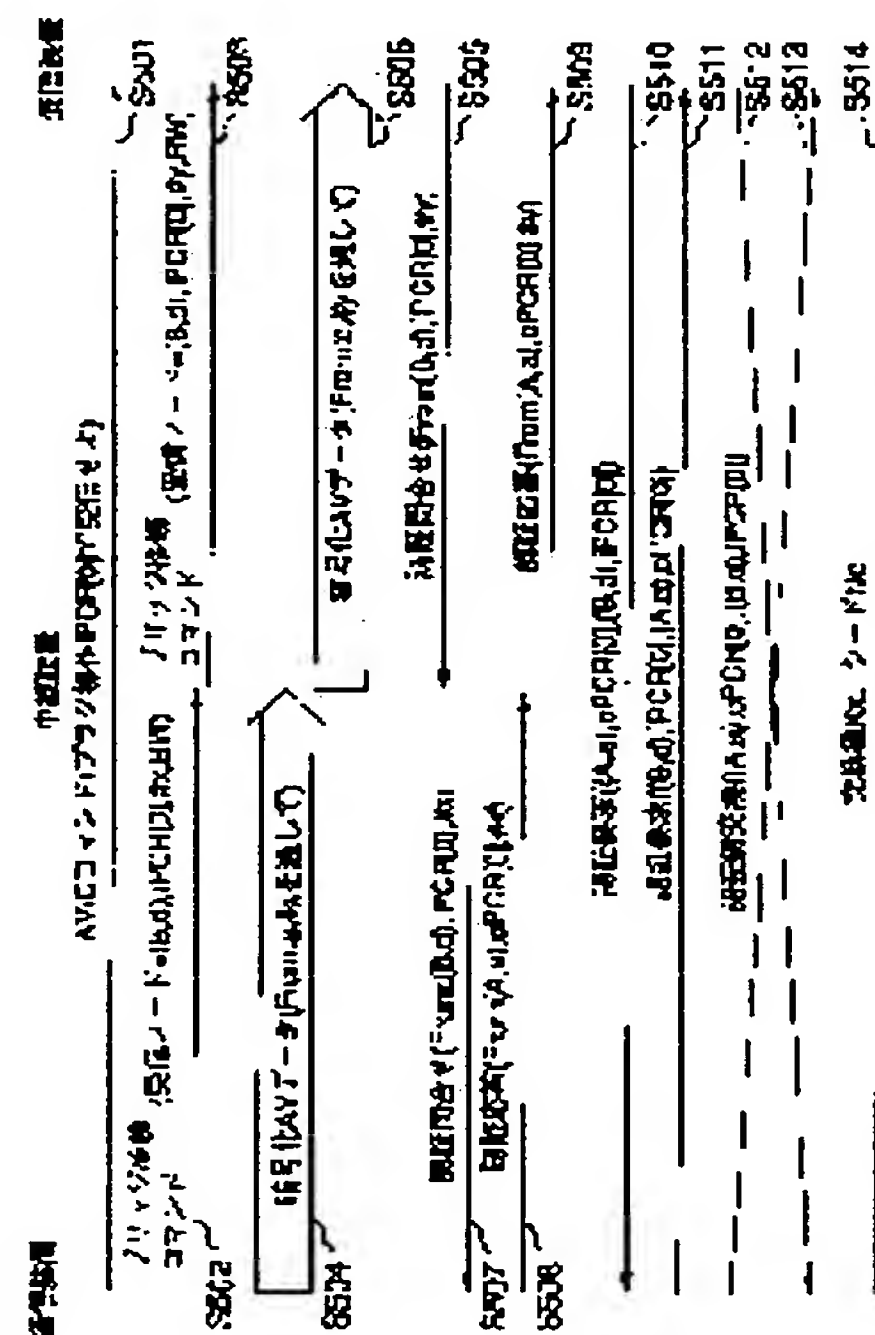
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(54) NETWORK CONNECTION DEVICE, COMMUNICATION UNIT AND NETWORK CONNECTION METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a network connection device that attains a contents protection procedure between devices not connected to the same network.

SOLUTION: A transmitter on a 1st IEEE 1394 bus transfers encrypted data to a receiver on a 2nd IEEE 1394 bus via a synchronous channel χ, a network connection device and a synchronous channel #Y. When the receiver receives the encrypted data, the receiver inquires the network connection device about information with respect to the transmitter. The network connection device inquires the information with respect to the transmitter transmitting data on the 1st IEEE 1394 bus in response to this inquiry and informs the receiver about the information with respect to the transmitter obtained thereby. The receiver directly conducts authentication.key exchange procedure with the transmitter on the basis of the received information.

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[Claims]

[Claim 1] A network connection device that connects a first IEEE 1394 bus and a second IEEE 1394 bus, said device comprising:

a data reception unit operable to receive data transferred from a transmission node connected to the first IEEE 1394 bus through a first synchronous channel or a first asynchronous stream channel on the first IEEE 1394 bus;

a data transfer unit operable to transfer the data, through a second synchronous channel or a second asynchronous stream channel on the second IEEE 1394 bus, to a reception node connected to the second IEEE1394 bus;

an inquiry reception unit operable to receive an inquiry from the reception node for information related to the transmission node, through a given packet on the second IEEE 1394 bus;

an inquiry unit operable to make an inquiry to the transmission node, through a given packet on the first IEEE 1394 bus, for the information;

a response reception unit operable to receive a response to an inquiry for the information from the transmission node through the given packet on the first IEEE 1394 bus; and

a response notification unit operable to notify the reception node of the response through the given packet on the second IEEE 1394 bus.

[Claim 2] The network connection device according to Claim 1,

wherein the given packet is one of a synchronous packet, an asynchronous stream and an asynchronous packet.

[Claim 3] The network connection device according to Claim 1,

wherein the response packet received by said response reception unit includes information which identifies the transmission node, as well as information which identifies a plug or a sub-unit of the transmission node utilized for transferring the data as information related to the transmission node.

[Claim 4] The network connection device according to one of Claim 2 and Claim 3,

wherein the reception node on the second IEEE 1394 bus is used for performing an authentication/key exchange procedure directly with the transmission node on the first IEEE 1394 bus based on the notified information.

[Claim 5] A network connection device that connects a first IEEE 1394 bus and a second IEEE 1394 bus, said device comprising:

a data reception unit operable to receive data transferred from a transmission node connected to the first IEEE 1394 bus through a first synchronous channel or a first asynchronous stream channel on the first IEEE 1394 channel;

a data transfer unit operable to transfer the data to a reception node connected to the second IEEE 1394 bus, through a second synchronous channel or a second asynchronous stream channel on the second IEEE 1394 bus;

an inquiry reception unit operable to receive an inquiry from the reception node for information related to the transmission node, through a given packet on the second IEEE 1394 bus;

an inquiry unit operable to, when the inquiry is received, make an inquiry through a given packet on the first IEEE 1394 bus to the transmission node for the information, assuming that a virtual plug or sub-unit of the device itself receives the data of the first synchronous channel;

a response reception unit operable to receive a response to the inquiry for information from the transmission node through the given packet on the first IEEE 1394 bus; and

a response notification unit operable to, when the inquiry has been received, notify the reception node, through the given packet on the second IEEE 1394 bus, of the response to the inquiry for information, a virtual plug or sub-unit of the device itself receives the data of the second synchronous channel..

[Claim 6] The network connection device according to Claim 5,

wherein the given packet is one of a synchronous packet, an asynchronous stream and an asynchronous packet.

[Claim 7] The network connection device according to Claim 5,

wherein the inquiry packet received by said inquiry reception unit includes information that identifies the reception node and information that identifies a plug or a sub-unit of the reception node used for the data transfer as information related to the reception node; and

the response packet received by said response reception unit includes information that identifies the reception node and information that identifies a plug or a sub-unit of the reception node used for the data transfer as information related to the reception node;

said network connection device further comprising:

a first authentication/key exchange processing unit operable to perform an authentication/key exchange procedure between a virtual plug or sub-unit of the transmission node that has responded to the inquiry on the first IEEE 1394 bus, and the virtual plug or sub-unit of the device itself; and

a second authentication/key exchange unit operable to perform an authentication/key exchange procedure between the virtual plug or virtual sub-unit of

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the device itself and a plug or sub-unit of the reception node on the second IEEE 1394 bus.

[Claim 8] The network connection device according to Claim 7, further comprising

an encryption key information reception unit operable to receive information related to an encryption key relative to the plug or sub-unit from the transmission node on the first IEEE 1394 bus, after the authentication/key exchange procedure by said first authentication/key exchange processing unit has completed; and

an encryption key information transfer unit operable to transfer the information related to the encryption key to the transmission node on the second IEEE 1394 bus, after at least a part of the authentication/key exchange procedure by said authentication/key exchange processing unit has completed.

[Claim 9] The network connection device according to one of Claim 1 and Claim 5, further comprising:

a storage unit operable to store correspondence among information that identifies the first synchronous channel or the first asynchronous stream channel, information that identifies the transmission node and information that identifies the second synchronous channel or the second asynchronous stream channel; and

wherein said network connection device makes the inquiry for the information to the transmission node determined with reference to the correspondence stored in said storage unit, based on the information that identifies the second synchronous channel or the second asynchronous stream channel and is included in the information received by said inquiry unit.

[Claim 10] A network connection device that connects a first network and a second network, the first network using one or more encryption keys for transmission and/or reception of encrypted data between nodes connected to the same network, and the second network using an identical encryption key for transmission and/or reception of encrypted data between nodes connected to the same network and transmitting and/or receiving data through a given channel, said device comprising:

a data reception unit operable to receive data transferred from a node connected to the first network;

a data transfer unit operable to transfer the data to a node connected to the second network, through a given channel on the second network;

an authentication request reception unit operable to receive an authentication request from the node connected to the second network;

an inquiry unit operable to make an inquiry, when the authentication request has been received, to a node connected to the second network for information that

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identifies a channel that the node is receiving;

a response reception unit operable to receive a response to the inquiry from the node connected to the second network; and

an encryption key information reception unit operable to receive information related to an encryption key for data, from the node connected to the first network, which transmits the data which should be transferred to a channel on the second network identified by information included in the response received by said response reception unit, to said device itself; and

an encryption key information transmission unit operable to transfer information related to the encryption key to a node on the second network.

[Claim 11] The network connection device according to Claim 10, further comprising:

a first authentication/key exchange processing unit operable to perform an authentication/key exchange procedure with the node connected to the first network which transmits, to said device itself, the data which should be transferred to the channel on the second network identified by the response; and

a second authentication/key exchange processing unit operable to perform an authentication/key exchange procedure with the node on the second network to which the data should be transferred through the channel on the second network identified by the response.

[Claim 12] A network connection device that connects a first network and a second network,

wherein pieces of data which belong to different flows but have the same control information are encrypted with different encryption keys between the device itself and an arbitrary device on the first network, and

data encryption of pieces of data having the same control information is carried out with the same encryption key between the device itself and an arbitrary device on the second network.

[Claim 13] A communications device that receives data from a transmission node on another IEEE 1394 bus through a network connection device connected to the same IEEE 1394 bus as said communications device itself, said communications device comprising:

a data reception unit operable to receive data transferred from the network connection device through one of a first synchronous channel and a first asynchronous stream channel on the same IEEE 1394 bus;

an inquiry unit operable to make an inquiry to the network connection device, in the case where the received data is encrypted, through a given packet on the same

IEEE 1394 bus, for information related to a transmission node of the encrypted data;

a response reception unit operable to receive a response to the inquiry for the information from the network connection device through the given packet on the same IEEE 1394 bus, the information being acquired by the network connection device which has received the inquiry by making the inquiry for the information on the another IEEE 1394 bus; and

an authentication/key exchange processing unit operable to perform an authentication/key exchange procedure directly with the transmission node on another IEEE 1394 bus, based on information included in the response received in said response reception unit.

[Claim 14] A communications device that receives data from a transmission node on another IEEE 1394 bus through a network connection device connected to the same IEEE 1394 bus as the device itself, said communications device comprising:

a data reception unit operable to receive data transferred from the network connection device through a first synchronous channel or a first asynchronous stream channel on the same IEEE 1394 bus;

an inquiry unit operable to make an inquiry to the network device, in the case that the received data is encrypted, through a given packet on the same IEEE 1394 bus, for information related to a transmission node of the encrypted data;

a notification reception unit operable to receive a response to the inquiry which includes information related to the transmission node indicating that the network connection device is the transmission node, from the network connection device which has received the inquiry, through the given packet on the same IEEE1394 bus,

an authentication/key exchange processing unit operable to perform an authentication/key exchange procedure with the network connection device based on information included in the notification received by said notification reception unit.

[Claim 15] A network connection method of connecting a first IEEE 1394 bus and a second IEEE 1394 bus, said method comprising the steps in which:

a transmission node on the first IEEE 1394 bus transmits encrypted data through the first synchronous channel;

the network connection device receives the encrypted data transferred from the transmission node through the first synchronous channel on the first IEEE 1394 bus, and transfers this data to a reception node connected to the second IEEE 1394 bus through a second synchronous channel on the second IEEE 1394 bus;

the reception node receives the data transferred through the second

synchronous channel on the second IEEE 1394 bus, and in the case that the data is encrypted, makes an inquiry to the network connection device through a given packet on the second IEEE 1394 bus, for information related to a transmission node of the encrypted data;

the network connection device makes an inquiry for the information related to the transmission node to the transmission node through the given packet on the first IEEE 1394 bus, in the case that the network connection device has received the inquiry for the information from the reception node through the given packet on the second IEEE 1394 bus;

the transmission node transmits a response to the inquiry for the information to the network connection device, through the given packet on the first IEEE 1394 bus, in the case that the transmission node has received the inquiry for the information from the network connection device through the given packet on the first IEEE 1394 bus;

the network connection device notifies the reception node of the response to the inquiry for the information through the given packet on the second IEEE 1394 bus in the case that the network connection device has received the response to the inquiry from the transmission node through the given packet on the first IEEE 1394 bus; and

the reception node performs an authentication/key exchange procedure directly with the transmission node based on information included in the notification.
[Claim 16] A network connection method of connecting a first IEEE 1394 bus and a second IEEE 1394 bus, said method comprising the steps in which:

a transmission node on the first IEEE 1394 bus transmits encrypted data through the first synchronous channel;

the network connection device receives the encrypted data transferred from the transmission node through the first synchronous channel on the first IEEE 1394 bus and transfers this data to a reception node connected to the second IEEE 1394 bus through a second synchronous channel on the second IEEE 1394 bus;

the reception node receives the data transferred through the second synchronous channel on the second IEEE 1394 bus and in the case that the data is encrypted, makes an inquiry to the network connection device for information related to the transmission node of the encrypted data through a given packet on the second IEEE 1394 bus, including information that identifies the reception node and information that identifies a plug or a sub-unit of the reception node which is utilized for the transfer of the encrypted data;

in the case where the network connection device has received the inquiry for the information related to the transmission node from the reception node through the given packet on the second IEEE 1394 bus, the network connection device makes an inquiry for the information to the transmission node through the given packet on the first IEEE 1394 bus, assuming that a virtual plug or sub-unit of the network connection device receives the data on the first synchronous channel, and notifies the reception node of a response to the inquiry for the information through the given packet on the second IEEE 1394 bus, assuming that the virtual plug or sub-unit of the network connection device transmits the data on the second synchronous channel;

in the case where the transmission node has received the inquiry for the information from the network connection device through the given packet on the first IEEE 1394 bus, the transmission node transmits a response to the inquiry for the information to the network connection device through the given packet on the first IEEE 1394 bus, the information including information that identifies the transmission node and information that identifies a plug or a sub-unit of the transmission node utilized for transferring the encrypted data; and

an authentication/key exchange procedure is performed between the plug or sub-unit of the transmission node and the virtual plug or sub-unit of the network connection device, and an authentication/key exchange procedure is performed between the virtual plug or sub-unit of the network connection device and the plug or sub-unit of the reception node.

[0137]　Here it is supposed that, unlike the first embodiment (assumed that an authentication/key exchange on IEEE 1394 is performed per AV data flow or AV/C plug and a plurality of encryption keys can be used within identical nodes per flow or per plug) only one encryption key can be defined within the same node (for this example, between the second relay 2103 and the reception device 2104) in the second IEEE1394 bus (2106) (however, for Never Copy content for example, even if a plurality of flows are being exchanged within the same node at the same time, the same encryption keys will be used for the flows having the same copy control information; note that copy control information is information in which how to handle copies of data that is sent is included, for example: "this data can be copied x amount of times," "this data cannot be written" and the like).　This point is the same even for the first IEEE1394 bus (2105) side (and even between transmission device 2101 and first repeating installation 2102).　In contrast, in a wireless LAN (2107), it is assumed different encryption keys can be used within identical nodes per flow or per plug, in the same way as the first embodiment.